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Original Article

Analysis of for Root Canal Obturation Techniques with Gutta Percha: An Observational Study

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***ABSTRACT*:**
Background: An ideal root canal filling should fill the entire root canal system in three dimensions and form a homogenous mass. Warm vertical (WV) compaction of gutta-percha was proposed in the 1960s, and this technique has been shown to lead to satisfactory results in terms of homogeneity and to fill a high percentage of the root canal area with gutta-percha material. **Aim of the study:** To analyze root canal obturation techniques with gutta percha. **Materials and methods:** The present study was conducted in the Department of Conservative dentistry and Endodontics of the Dental institution. For the study, we used 100 extracted permanent maxillary central incisors with single canal and completed apex formation. We excluded teeth with morphological anomalies and multiple root canals to avoid any bias in the results. For the preparation of root canals, access cavity was made and the canal was located using a #8 K-file. After the canals were located, we cut the crowns of the teeth such that the working length of the canal was standardized at 22 mm for all teeth. The biomechancal preparation of the canals was done using K-files. **Results:** Mean gutta percha weight in Group 1 which were obturated with mechanical lateral condensation technique was **11.65 ± 2.1 g**. Mean gutta percha weight in Group B which were obturated with conventional lateral condensation technique was **8.20 ± 1.8 g**. **Conclusion**: From the above results of the study, this can be concluded that both the techniques are quite effective in sealing the root canal; however, out study has demonstrated that MLC is superior to CLC.
Key words: Root canal treatment, gutta percha, root canal fillings.

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INTRODUCTION:

An ideal root canal filling should fill the entire root canal system in three dimensions and form a homogenous mass. Warm vertical (WV) compaction of gutta-percha was proposed in the 1960s, and this technique has been shown to lead to satisfactory results in terms of homogeneity and to fill a high percentage of the root canal area with gutta-percha material.[1] However, the armamentarium required for this technique is considerably more expensive than is required for cold lateral (CL) compaction. Another criticism of this thermoplasticized technique is that apical control of the filling material can be difficult at times, and some material may be extruded beyond the apical foramen.[2] Suitable physical properties of Gutta-percha (GP) as the most common root canal obturation material, allow it to apply in several obturation techniques.[3] Although cold lateral condensation is the most commonly used technique, but voids, spreader tracts, incomplete fusion of GP cones, and lack of surface adaptation are among the reported drawbacks.[4] Thermoplasticized injectable techniques were introduced to improve the homogeneity and surface adaptation of GP. Various experimental methods have been used to assess the quality of root fillings, such as: radioisotope, dye penetration, fluid filtration, bacterial leakage, microscopic analysis, clearing techniques and

micro-computed tomography (micro-CT) [8-15]. In endodontics, micro-CT has been used for evaluation of root canal anatomy and morphology following instrumentation.[5, 6] Hence, the present study was conducted to analyze root canal obturation techniques with gutta percha.

MATERIALS AND METHODS:

The present study was conducted in the Department of Conservative dentistry and Endodontics of the Dental institution. The study was approved from the ethical committee of the institute prior to commencement of the study. For the study, we used 100 extracted permanent maxillary central incisors with single canal and completed apex formation. We excluded teeth with morphological anomalies and multiple root canals to avoid any bias in the results. The teeth were immersed in the dilute hypochlorite solution for 48 hours to remove any organic debris on the teeth. After 48 hours, the teeth were immersed in the normal saline solution until the commencement of the study.

For the preparation of root canals, access cavity was made and the canal was located using a #8 K-file. After the canals were located, we cut the crowns of the teeth such that the working length of the canal was standardized at 22 mm for all teeth. The biomechanical preparation of the canals was done using K-files. After completion of the biomechanical preparation of the canal, the teeth were randomly grouped into two groups, Group A and B, with 50 teeth in each group. The teeth in Group 1 were obturated with size 30 gutta-percha master cone and size 15 gutta-percha accessory cones with conventional lateral condensation technique using finger spreaders. The teeth in Group 2 were obturated with size 30 gutta-percha master cone and size 15 gutta-percha accessory cones using mechanical lateral condensation technique (MLC) employing a reciprocating handpiece. All the procedures were performed by a single operator. The teeth were weighed before and after the completion of obturation. This difference in weight showed the weight of gutta percha mass. The data was stored for further evaluation.

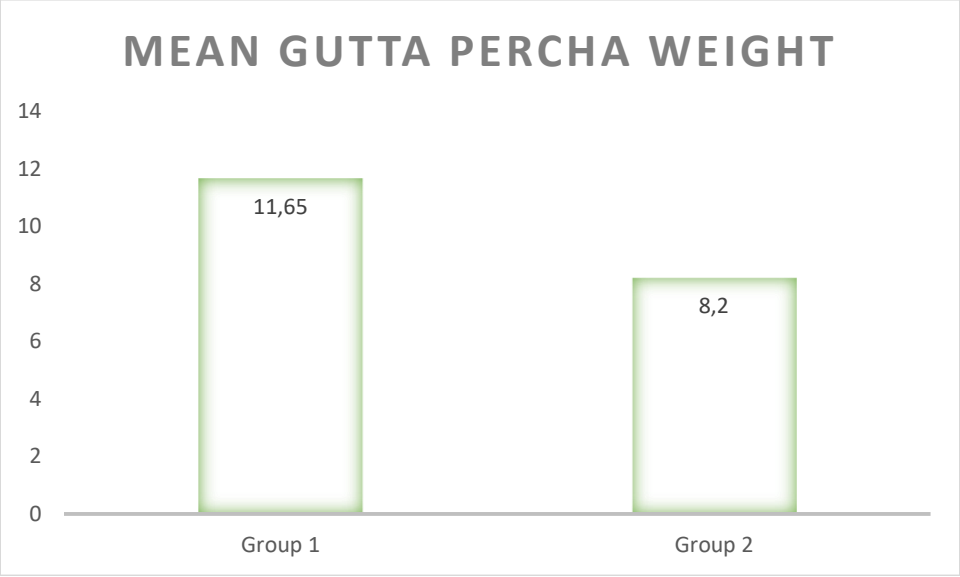
RESULTS:

Table 1 shows the mean gutta percha weight in both the techniques. Mean gutta percha weight in Group 1 which were obturated with mechanical lateral condensation technique was **11.65 ± 2.1 g**. Mean gutta percha weight in Group B which were obturated with conventional lateral condensation technique was **8.20 ± 1.8 g**. On comparing the results, it was seen that the results are statistically non-significant ($p<0.05$)

Table 1: Mean gutta percha weight in Group 1 and Group 2

Groups	Mean Gutta Percha weight	p-value
Group 1(Mechanical lateral condensation technique)	**11.65±2.1 g**	**0.41**
Group 2(Conventional lateral condensation technique)	**8.20 ± 1.8 g**	

Figure 1: Mean gutta percha weight



DISCUSSION:

In the present study, we compared two commonly used obturation techniques for obturation of rroot canals. We studied mechanical lateral condensation and conventional lateral condensation for gutta percha obturation in the root canal. Our results have shown that both the techniques are effective in sealing the root canal. MLC is found to be more effective. The results are statistically non-significant. Shan Ho ES et al compared the density of gutta-percha root fillings obturated with the following techniques: cold lateral (CL) compaction, ultrasonic lateral (UL) compaction, and warm vertical (WV) compaction. Thirty-three extracted mandibular first molars, with two separate mesial canals in each, were selected. After instrumentation, the canals were stratified into three groups based on canal length and curvature, and underwent obturation with one of the techniques. No sealer was used in order to avoid masking any voids. The teeth were imaged pre- and post-obturation using micro-computed tomography. The reconstructed three-dimensional images were analyzed volumetrically to determine the amount of gutta-percha present in every 2 mm segment of the canal. The overall mean volume fraction of gutta-percha was 68.51 ± 6.75% for CL, 86.56 ± 5.00% for UL, and 88.91 ± 5.16% for WV. Significant differences were found between CL and UL and between CL and WV, but not between UL and WV. The gutta-percha density of the roots treated with WV and UL increased towards the coronal aspect, but this trend was not noted in the CL group. It was concluded that WV compaction and UL compaction produced a significantly denser gutta-percha root filling than CL compaction. The density of gutta-percha was observed to increase towards the coronal aspect when the former two techniques were used. Naseri M et al compared the quality of four different root canal obturation techniques: cold lateral condensation (CLC), warm vertical condensation (WVC), Obtura II (OII) and Gutta Flow (GF) by using micro-computed tomography (micro CT). A total of 20 extracted maxillary first molars prepared with ProTaper files, were randomly divided into four groups. Micro CT was used to measure the internal volume of root canals. Following application of AH26 sealer to canal obturation, new micro-CT images were taken and the volume percentage (VP) of voids, gutta-percha and sealer at different levels were calculated with CT software. Data was statistically analyzed using Kruskal-Wallis and Mann-Whitney U tests. The highest percentage of filling material was observed in GF group followed by OII with no statistically significant difference. These two groups had a significantly more acceptable filling than WVC and CLC groups. Voids were detected in all samples. There was a significant difference between the highest and the lowest percentage of voids in CLC (19.6%) and GF groups (6.7%), respectively. In the apical third, CLC and OII showed the highest and the lowest percentage of voids (5.5% and 2.6%) and the lowest and highest percentage of gutta-percha (76.52% and 94.26%), respectively. These differences were statistically significant. They concluded that none of the root canal filled teeth were gap-free. GF , and CLC techniques showed the highest and lowest VP of obturation materials, respectively.[7, 8]

Olczak K et al evaluated the sealing ability of three different canal filling techniques. Sixty-four roots of extracted human maxillary anterior teeth were prepared using ProTaper® rotary instruments. The specimens were then randomly divided into 3 experimental groups (n = 16) and 2 control groups (n = 8). The root canals were filled using cold lateral compaction (CLC group), continuous wave condensation technique using the Elements Obturation Unit® (EOU group), and ProTaper obturators (PT group). For the negative control group, 8 roots were filled using lateral compaction as in the CLC group, and the teeth were covered twice with a layer of nail varnish (NCG group). Another 8 roots were filled using lateral compaction, but without sealer, and these were used as the positive control (PCG group). A glucose leakage model was used for quantitative evaluation of microleakage for 24 hours and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 weeks. No significant difference in the cumulative amount of leakage was found between the three experimental groups at all observation times. They concluded that the lateral condensation of cold gutta-percha can guarantee a similar seal of canal fillings as can be achieved by using thermal methods, in the round canals. Gordon MP et al compared the area occupied by gutta-percha, sealer, or void in standardized .06 tapered prepared simulated curved canals and in mesio-buccal canals of extracted maxillary first molars filled with a single .06 gutta-percha point and sealer or lateral condensation of multiple .02 gutta-percha points and sealer. Simulated canals in resin blocks with either a 30 degrees curve and radius of 10.5 mm (n = 20) or a 58 degrees curve and 4.7 mm radius (n = 20) and curved mesio-buccal canals of extracted maxillary first molars (n = 20) were prepared using .06 ProFiles in a variable tip crown-down sequence to an apical size 35 at 0.5 mm from the canal terminus or apical foramen. Ten 30 degrees and 58 degrees curved resin canals and 10 canals in the extracted teeth group were obturated with .02 taper gutta-percha cones and AH 26 sealer using lateral condensation. The time required to obturate was recorded. The remaining canals were obturated with a single .06 taper gutta-percha cone and AH 26 sealer. The cross-sectional area of the canal contents was analysed using Adobe PhotoShop. The percentage of gutta-percha, sealer or voids to the total root canal area were derived and data analysed using unpaired Student's t-test and the Mann-Whitney U-test. In the 30 degrees curved canals the levels had between 94 and 100% of the area filled with gutta-percha with no significant difference between the lateral condensation and single cone techniques. In the 58 degrees curved canals the levels had 92-99% of the area filled with gutta-percha, with the single cone technique having significantly more gutta-percha fill at the 2.5 mm level only. In the mesio-buccal canals of the

teeth the levels had between 72 and 96% of the area filled with gutta-percha with no significant difference between the lateral condensation and single cone technique. The time for obturation was significantly greater for lateral condensation compared with the single cone technique in all groups. They concluded that the .06 taper single cone technique was comparable with lateral condensation in the amount of gutta-percha occupying a prepared .06 tapered canal. The .06 single cone technique was faster than lateral condensation.[9, 10]

CONCLUSION:

From the above results of the study, this can be concluded that both the techniques are quite effective in sealing the root canal; however, out study has demonstrated that MLC is superior to CLC.

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